

The relationship between in-home water service and infectious disease among Alaska Natives

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Research Question

- **Has provision of sanitation facility infrastructure improved the health of Alaska Natives?**

BACKGROUND INFORMATION



Alaska Native Tribal Health Consortium (ANTHC)

- ANTHC is a non-profit, statewide organization that provides a range of medical and community health services for more than 125,000 Alaska Natives.
- ANTHC is the largest Tribally managed health organization in the country with 1,700 employees and an annual budget of \$300 million.



ANTHC Mission/Vision

- Mission: To provide the highest quality health services for all Alaska Natives
- Vision: Alaska Natives are the healthiest people in the world



ANTHC: Division of Environmental Health and Engineering

- DEHE provides public health related programs including environmental health, injury prevention, and O&M assistance
- DEHE manages public health related sanitation and healthcare facility construction projects statewide
- Annual construction effort for health and sanitation facilities of approx. \$70M



DEHE Partners & Contributors

- **Native Health Organizations**

- **Denali Commission**



- **Other sanitation and health facility funding agencies (EPA, Rural Development, etc.)**



- **Indian Health Service**



- **State of Alaska**



There is Still Very Basic Service in 34% of Alaskan Villages



Basic Sanitation is a Serious Problem in Rural Alaska

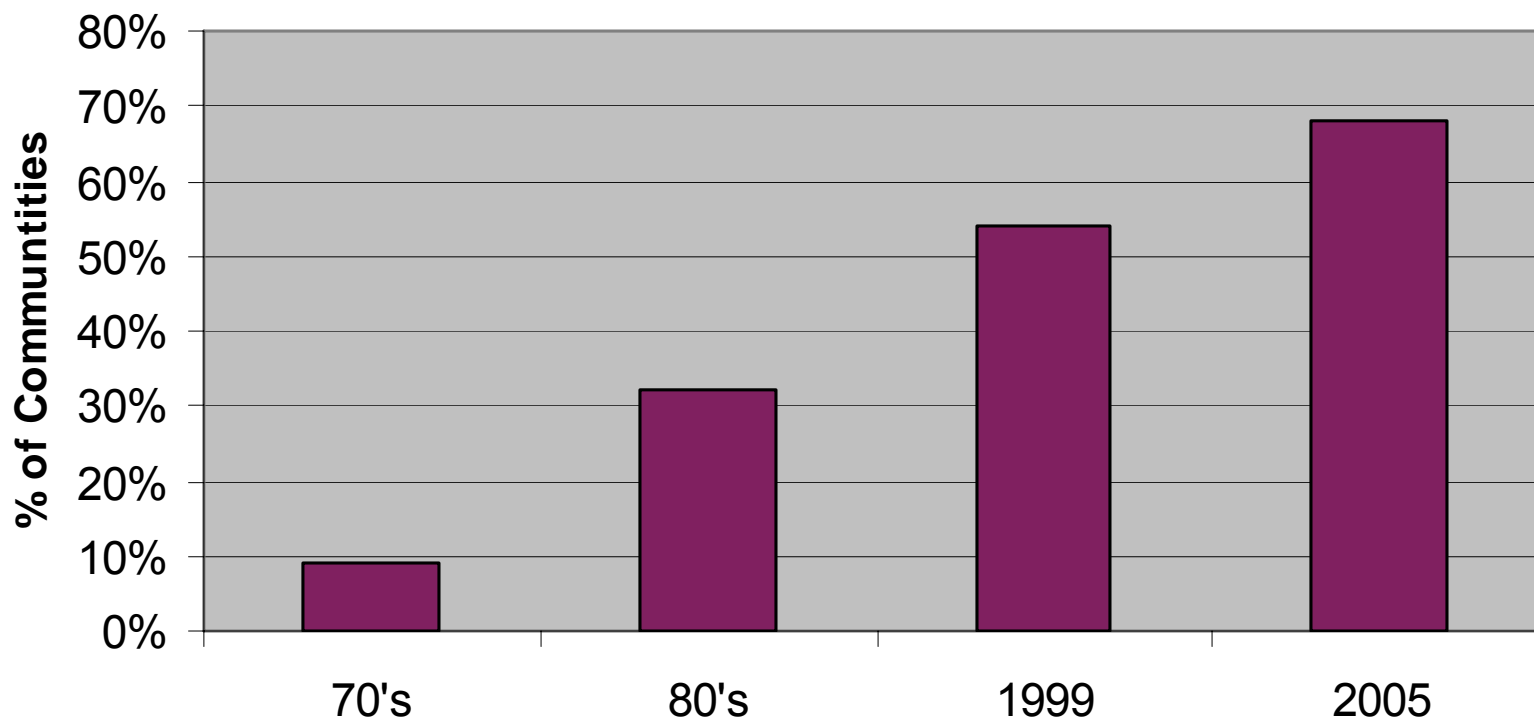


Dumping Frozen Sewage Bunkers



Growth of Sanitation Service in Rural Alaska

Communities with >60% of Homes Served with Piped Water

















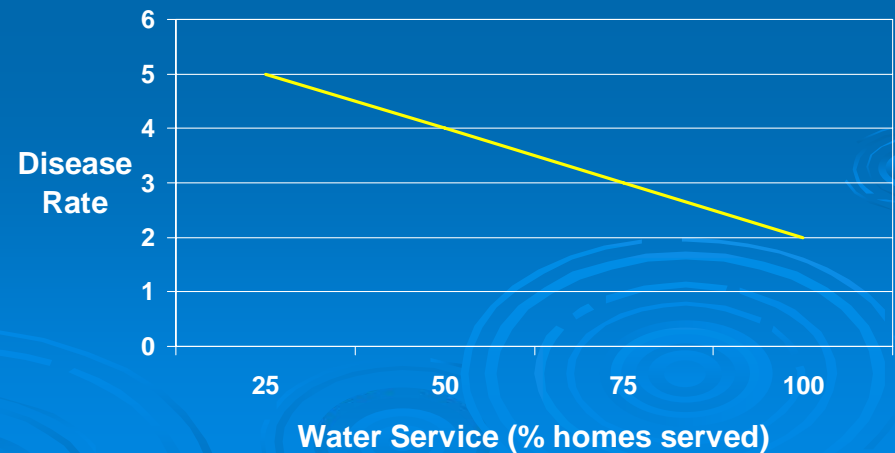


A group of five children are standing in a line in front of a building with a prominent red door. From left to right: a boy in a dark long-sleeved shirt, a girl in a red t-shirt, a girl in a light purple t-shirt, a boy in a colorful patterned shirt, and a boy in a blue and white jacket. They are all smiling at the camera. The background shows a building with a red door and some greenery to the left.

PROJECT DETAILS

Basic Analysis

- **Compared disease rates to availability of in-home water service:**
 - On a statewide basis.
 - Within one region



A photograph of two young children standing in a snowy yard. The child on the left is wearing a light blue jacket and red boots. The child on the right is wearing a white jacket, a blue hat, and white boots. They are standing on a circular concrete patch. In the background, there is a green house and a grey house. The text "DATA SOURCES" is overlaid in large blue letters.

DATA SOURCES

APR 30 200

Determining Water Service

- ❖ Rural Alaska Housing Sanitation Inventory (RAHSI)
 - Raw data



Disease Data Sources

➤ IHS Hospital Discharge Records

- Int'l Classification of Diseases (ICD-9-CM)
- Gastroenteritis, pneumonia and influenza, skin/soft tissue infections, MRSA infections, RSV infections
- 2000-2004

➤ Ongoing Surveillance

- Respiratory disease
- Collected since 1994

➤ Outbreak Investigation Information

- Skin infections
- 1999-2000

RESULTS

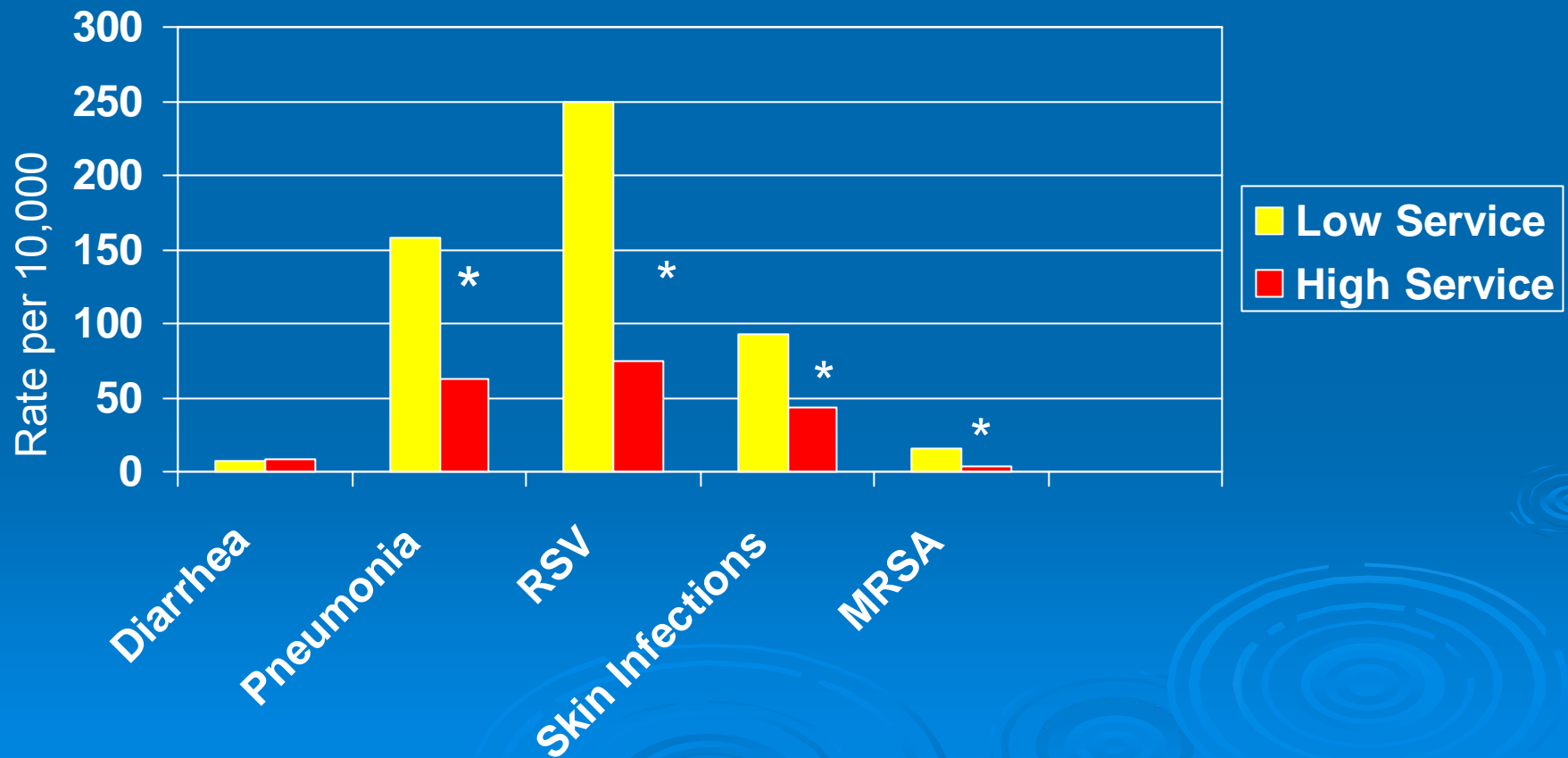


Statewide Comparison of “high” and “low” service regions

High Service Region- at least 80% of homes with internally plumbed water service.

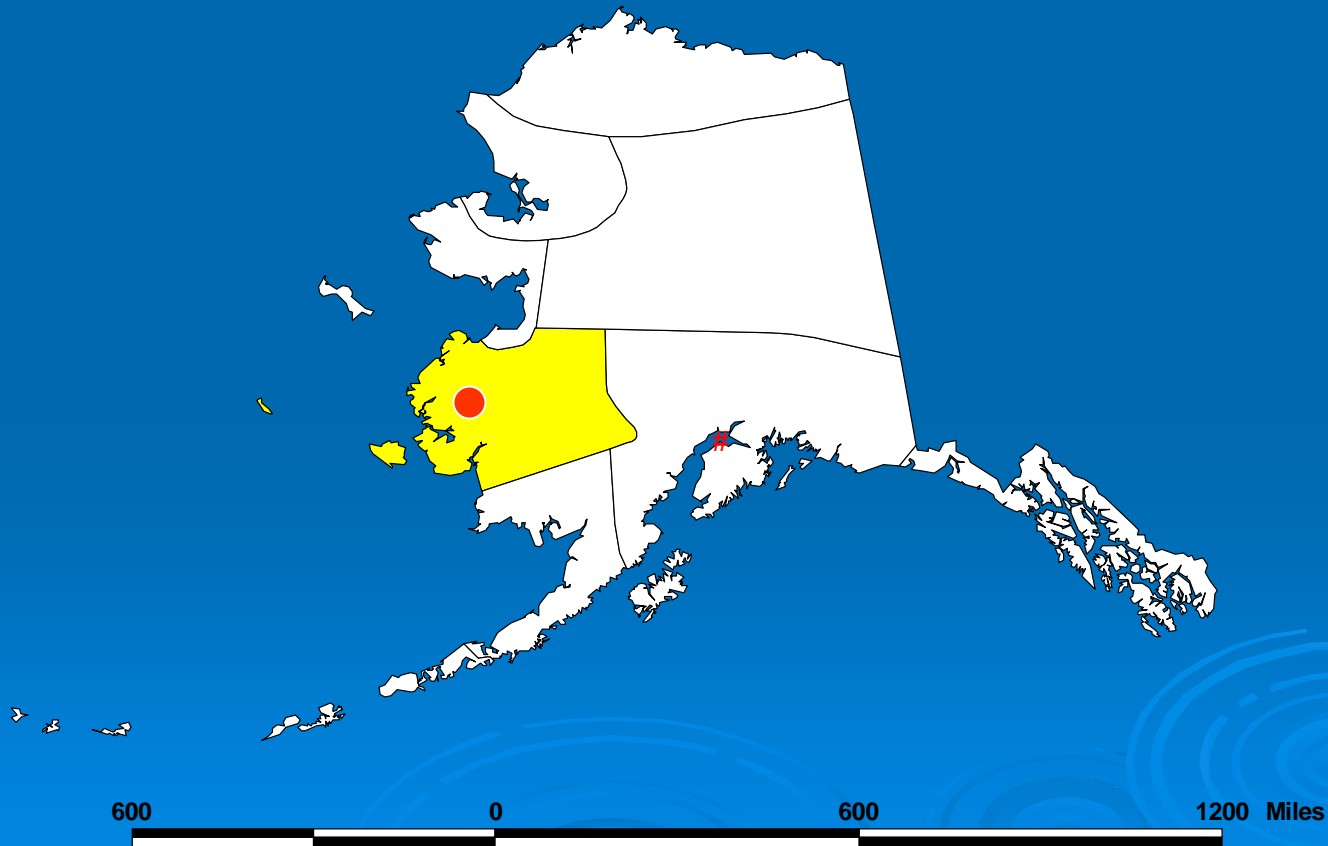
Low Service- less than 80% of homes with internally plumbed water service.

Hospitalization Rates for “High” and “Low” Water Service Regions, Alaska, 2000-2004

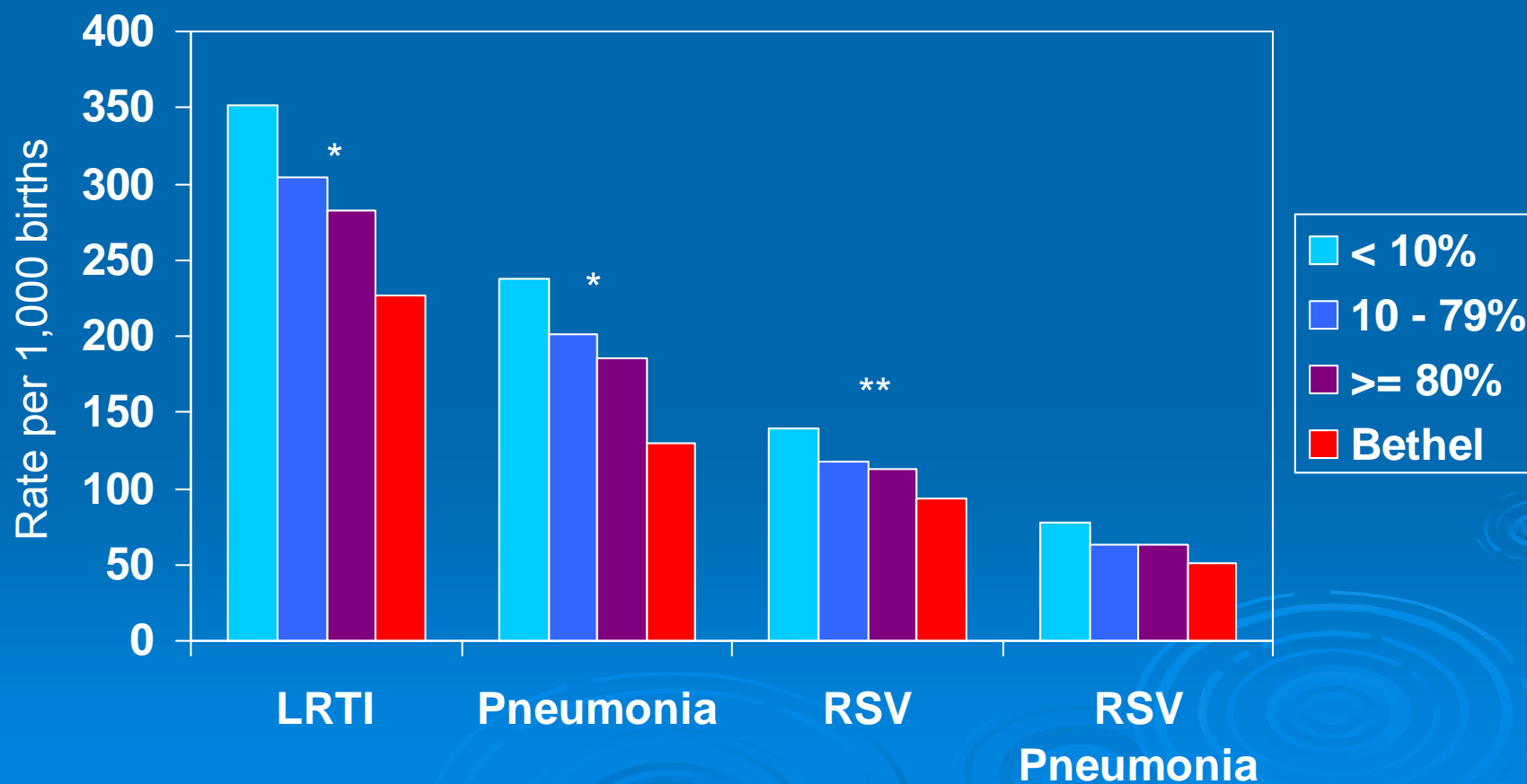


* $P < 0.05$

Analysis within the Yukon-Kuskokwim Delta Region



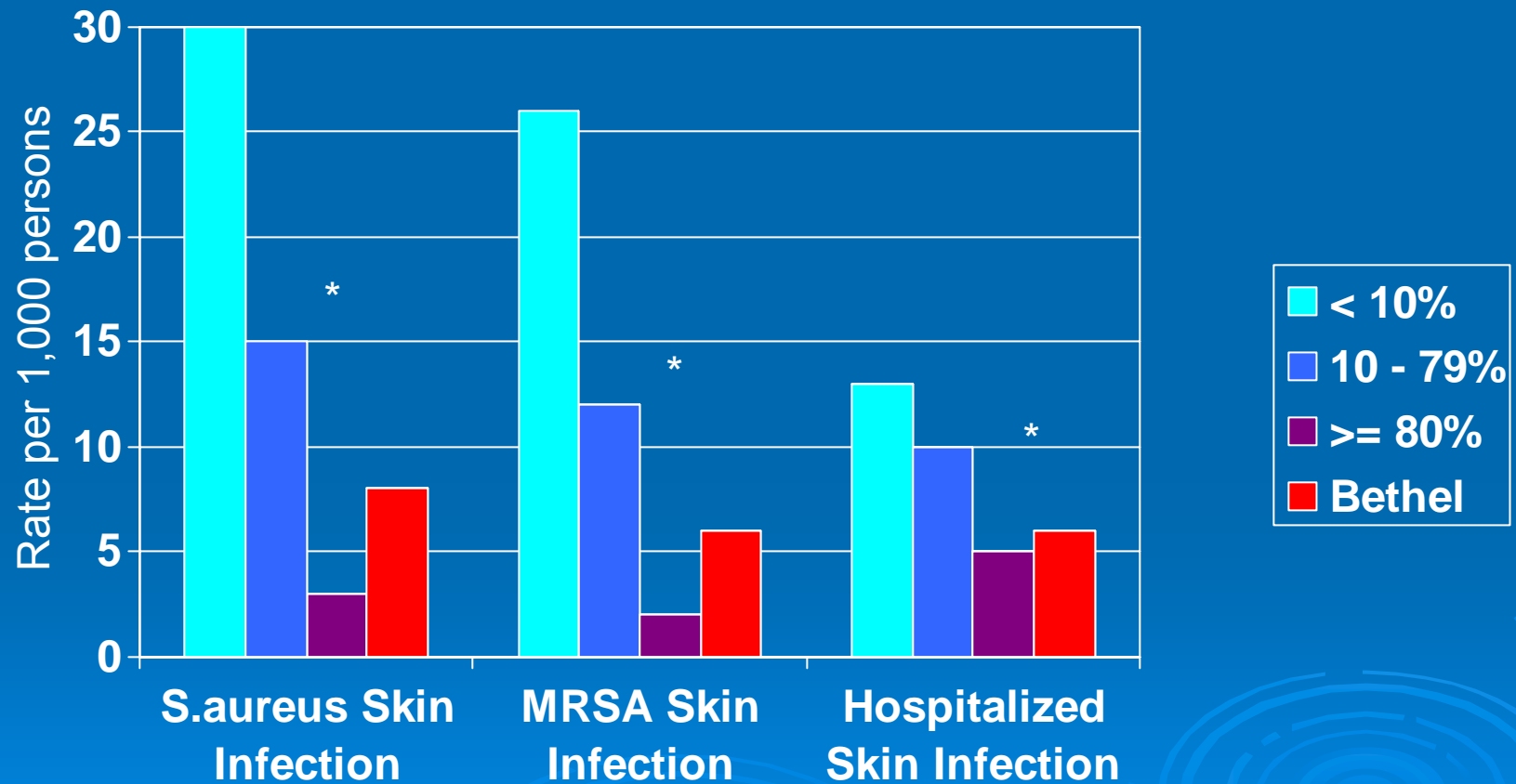
Hospitalization rates for children < 3 yrs old according to water service in village of residence, YK region, 1999-2004



* $P < 0.05$ for trend,

** $P = 0.08$ for trend

Skin infection rates compared with water service in village of residence, all ages, YK Region, 1999-2000



* $P < 0.001$ for trend

DISCUSSION



Why Respiratory Infections?



Mechanism

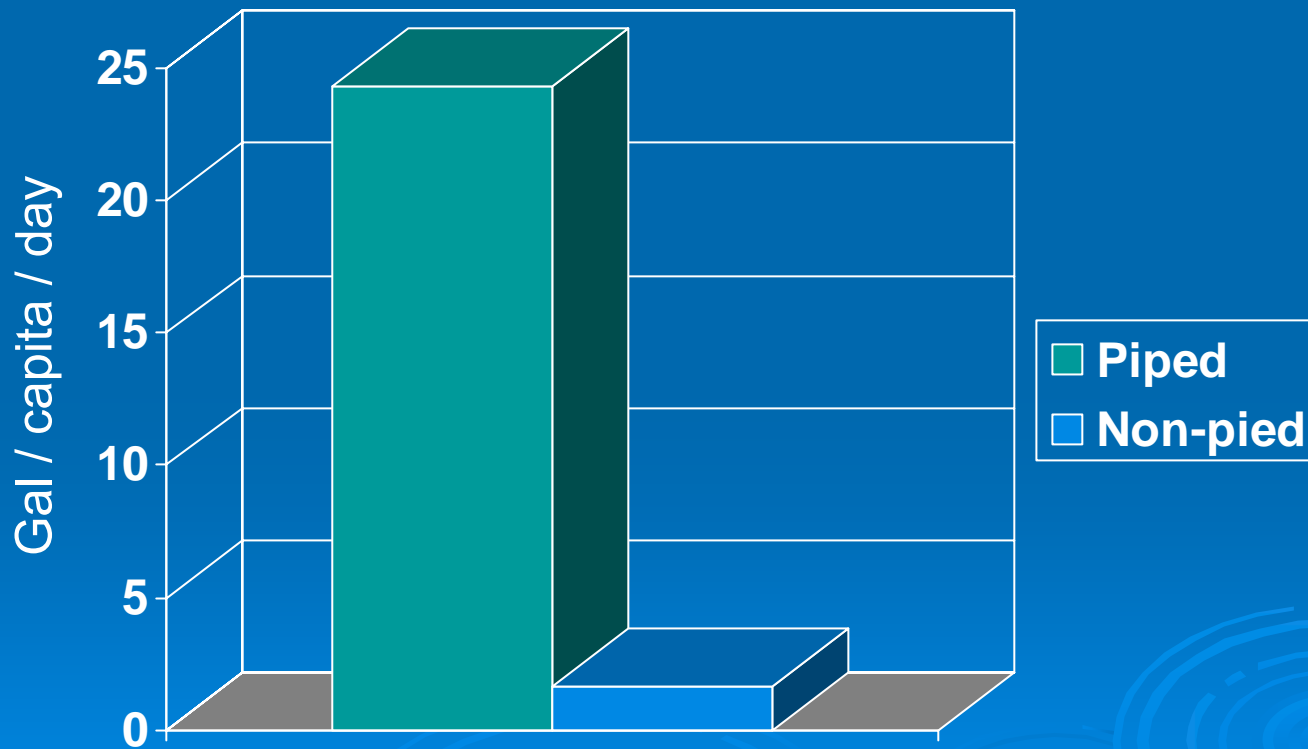
- ⇒ Increased access to water leads to...
- ⇒ Increased water consumption ¹...
- ⇒ Increased sanitation & hygiene practices ²...
- ⇒ Reduced respiratory disease ³.

1) White G.F., Bradley Dj and White AU (1972) Drawers of Water: Domestic Water Use in East Africa. Chicago, Ill: Chicago University Press.

1) Curtis V., Kanki B., Mertens T. *et al.* (1995) Potties, pits and pipes: explaining hygiene behavior in Burkina Faso. *Social Science and Medicine* 41(3):383-93

2) Luby, S.P, Agboatwalla, M., Feikin, D.R., Painter, J., Billhimer, W., Altaf, A., Hoekstra, R.M., (2005). "Effect of handwashing on child health: a randomized controlled trial.: Lancet, Vol 366, 225-33.

Average Potable Water Consumption: Piped vs. Non-piped, Alaska



** Based on preliminary consumption data from 4 non-piped communities and 3 piped communities.*

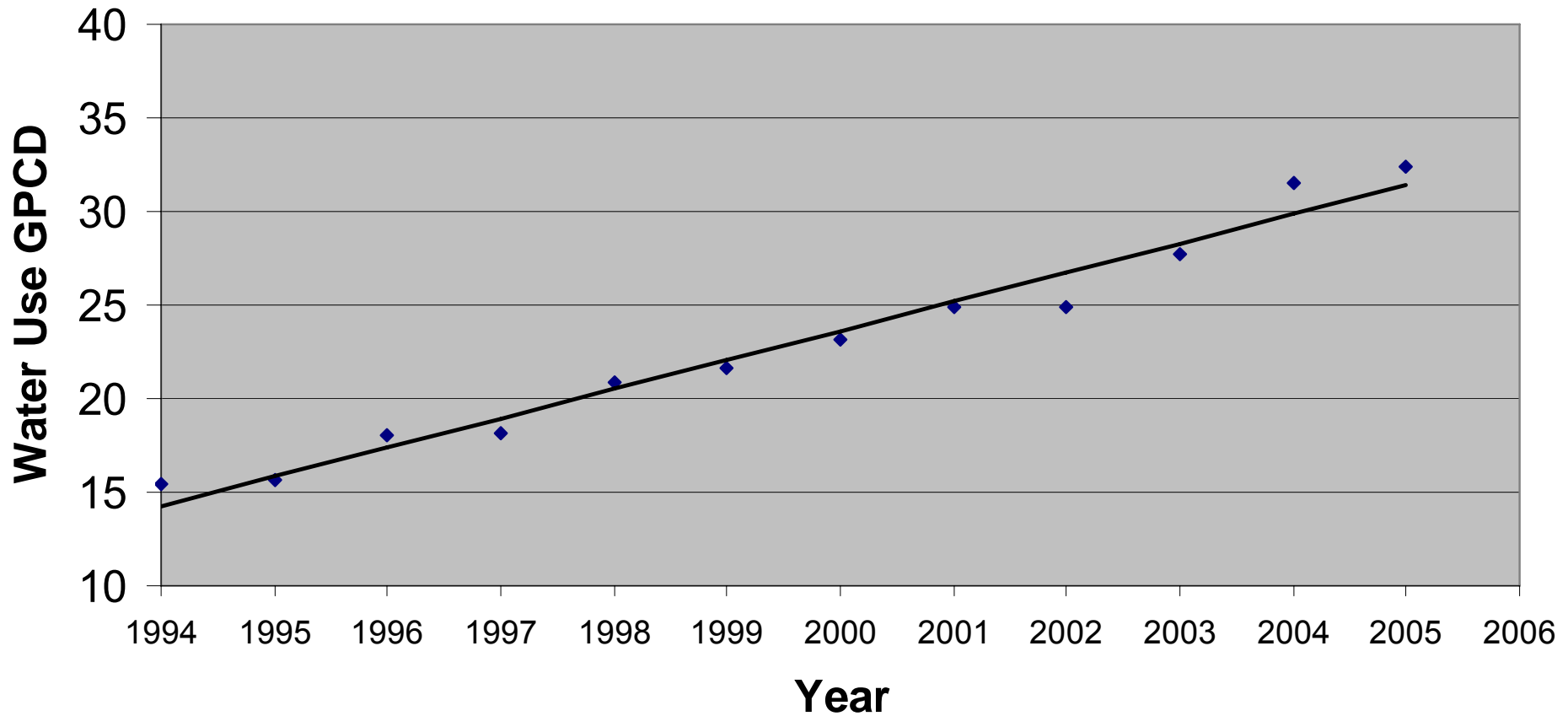


Collecting Water:

Red Devil, AK



Noorvik Water Use





2002 9 5

***Why not* Diarrhea**



Classifications of Water-Related Disease

- **Water-borne**: Disease caused by drinking contaminated water
- **Water-washed**: Disease caused by inadequate quantity of water for hygienic practices.



PUBLIC
WATERING
POINT

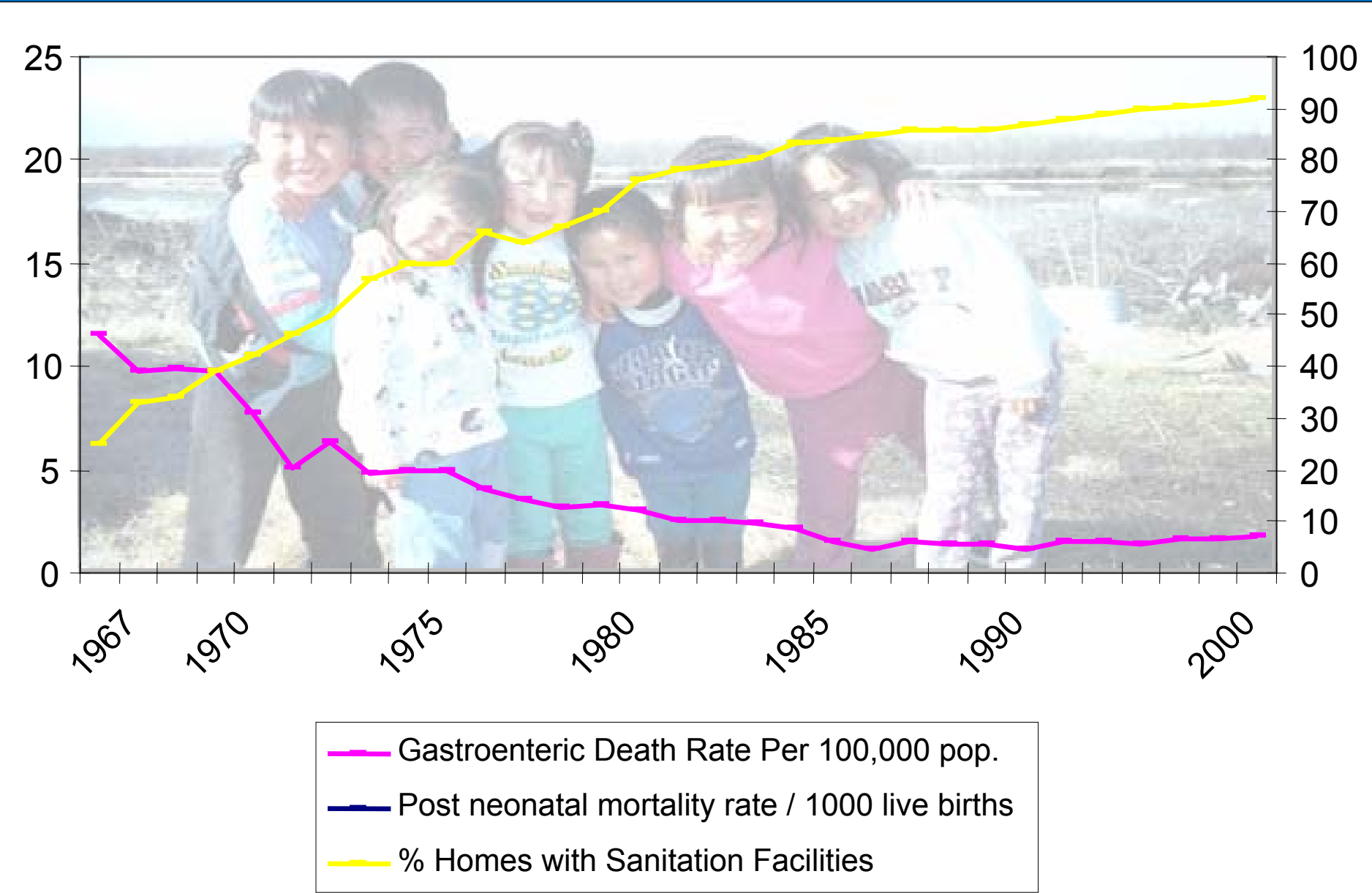
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Gastrointestinal mortality rates compared with percent of American Indian and Alaska Native homes having sanitation facilities



So... *Why not* Diarrhea

- Alaska Natives are already enjoying the health benefits of potable water service!



The results of this study are:

- Consistent with what we know about water service and health.
- Biologically plausible.
- Supported by other research.

Conclusion

Provision of sanitation facility infrastructure is associated with reductions in infectious disease among Alaska Natives.



Recommendations

- Continue to provide sanitation infrastructure that delivers convenient access to adequate quantities of water.
- Develop a better understanding of water consumption factors and determinants.
- Recognize acute respiratory infections as an important indicator of sanitation conditions.
- Mobilize and utilize the assets of the environmental health program to assist with the RSV epidemic.
- Improve ability to collect comprehensive water-related disease statistics at the local community level.
- Conduct a follow-up study.

“Ideal” Experimental Design

- Two randomly selected groups of communities
 - No water service
 - Similar in all important ways
- One group gets water service, other group does not
- Disease rates, water use measured over time
- Compare and draw conclusions

Thanks to...

➤ **CDC Arctic Investigations Program**

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➤ **Alaska Native Tribal Health Consortium**

- Rosalyn Singleton, MD

Villages Grouped by Water Service, YKHC Region

	Level of Water Service			Bethel, ≥ 80%
	< 10%	10 – 79%	≥ 80%	
Villages	20	13	14	1
Population	6956	4743	6415	5459
Village Size, (median)	312	370	493	5459
Household members	4.7	4.2	4.2	4.2
Household Income	\$30,633	\$28,393	\$31,160	\$57,321
Unemployed	23%	20%	20%	9%
% Alaska Native Persons	98%	98%	93%	71%